

Assessing Disparities of Dengue Virus Transmission Risk across the US-Mexican Border Using a Climate Driven Vector-Epidemiological Model

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Dengue fever is a mosquito-borne viral disease reemerging throughout much of the tropical Americas. Dengue virus transmission is explicitly influenced by climate and the environment through its primary vector, *Aedes aegypti*. Temperature regulates *Ae. aegypti* development, survival, and replication rates as well as the incubation period of the virus within the mosquito. Precipitation provides water for many of the preferred breeding habitats of the mosquito, including buckets, old tires, and other places water can collect. Although transmission regularly occurs along the border region in Mexico, dengue virus transmission in bordering Arizona has not occurred. Using NASA's TRMM (Tropical Rainfall Measuring Mission) satellite for precipitation input and Daymet for temperature and supplemental precipitation input, we modeled dengue transmission along a US-Mexico transect using a dynamic dengue transmission model that includes interacting vector ecology and epidemiological components. Model runs were performed for 5 cities in Sonora, Mexico and southern Arizona. Employing a Monte Carlo approach, we performed ensembles of several thousands of model simulations in order to resolve the model uncertainty arising from using different combinations of parameter values that are not well known. For cities with reported dengue case data, the top model simulations that best reproduced dengue case numbers were retained and their parameter values were extracted for comparison. These parameter values were used to run simulations in areas where dengue virus transmission does not occur or where dengue fever case data was unavailable. Additional model runs were performed to reveal how changes in climate or parameter values could alter transmission risk along the transect. The relative influence of climate variability and model parameters on dengue virus transmission is assessed to help public health workers prepare location specific infection prevention strategies.